



Training Basic Hydraulics



ENGINEERING **YOUR** SUCCESS.

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The Best Power to Weight Ratio of All Energy Conversion Systems

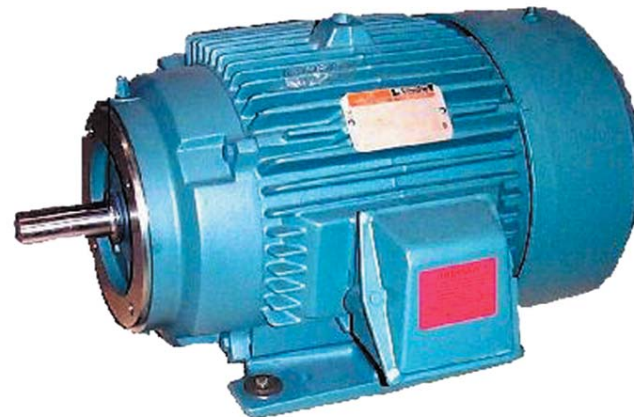


Hydraulic motor:

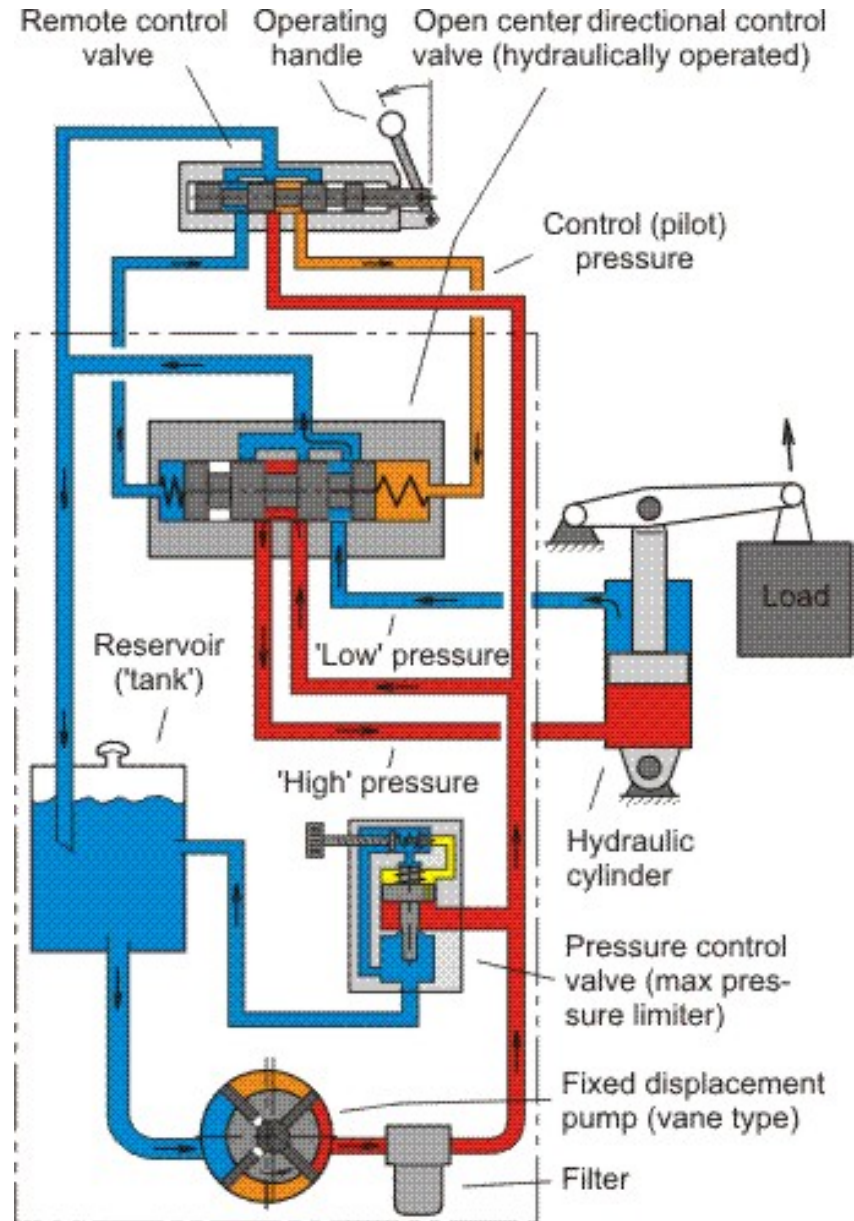
- displacement: $5 \text{ cm}^3/\text{r}$ ($0.30 \text{ in}^3/\text{r}$)
- continuous speed 8500 rpm
- continuous power 13kW (17.5 hp)
- length 134mm (5.28 in)
- weight 5 kg (11 lb)

Electric motor:

- speed 2900 rpm
- power 11kW (15 hp)
- length 320mm (12.6 in)
- weight 65 kg (145 lb)

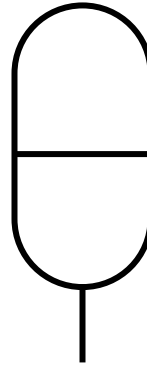


Simple Hydraulic System

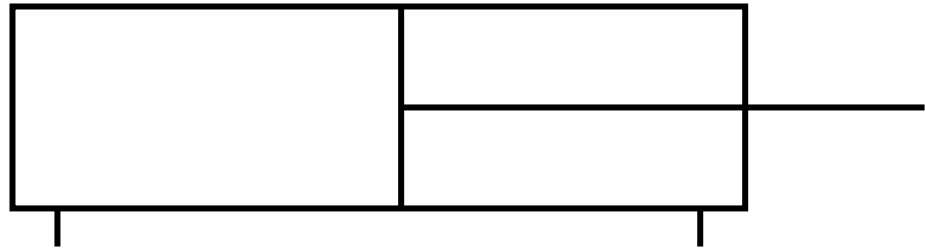


Hydraulic Schematic Symbols

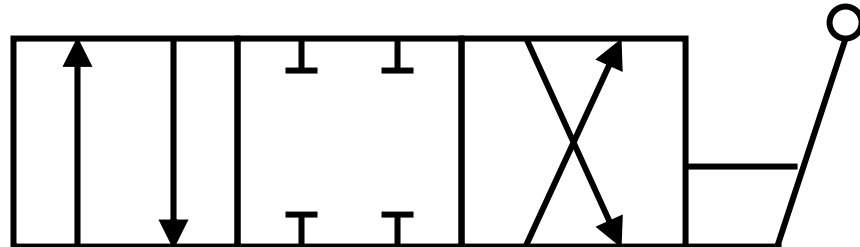
Accumulator



**Cylinder
Double acting**



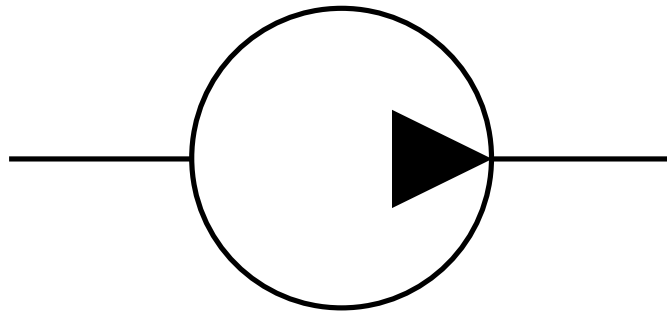
**Directional Control Valve
(manually operated)**



Dump Pumps



Hydraulic System Components: Gear Pump



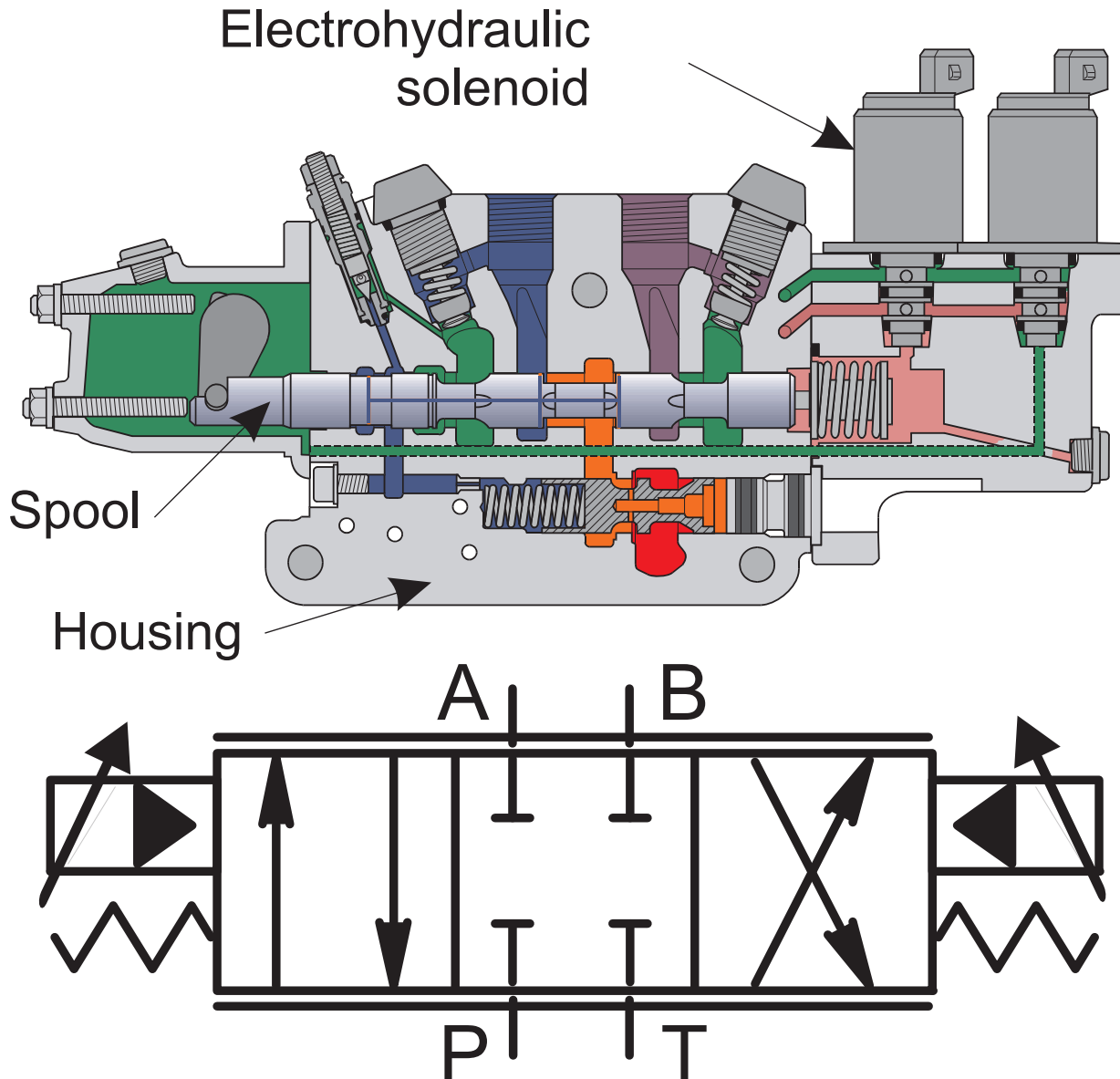
Hydraulic Pump Symbol

Hydraulic System Components : Accumulator

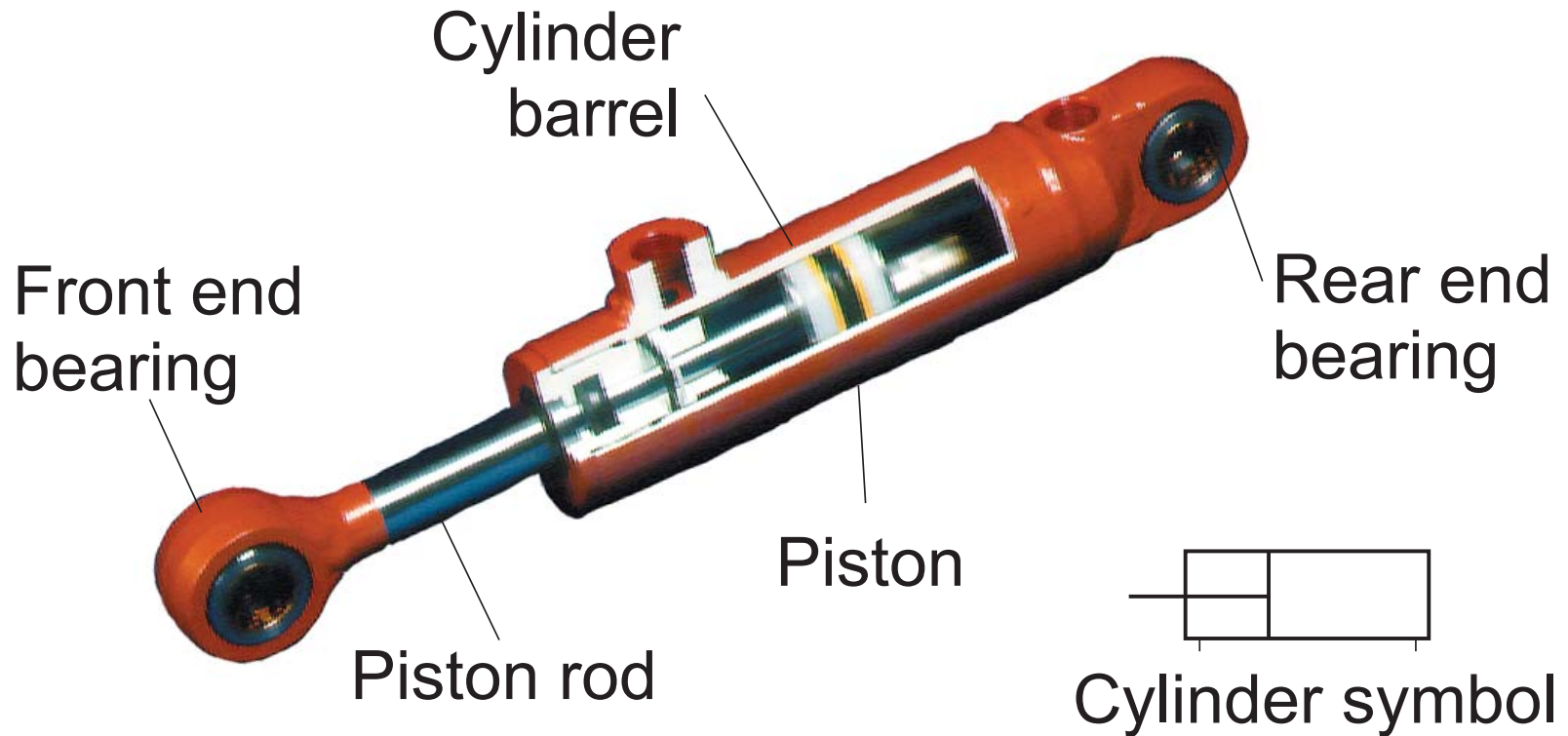


Accumulator symbol

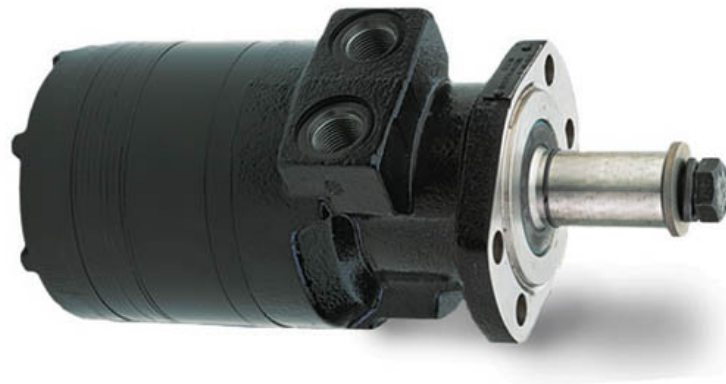
Hydraulic System Components : Directional Control Valve



Hydraulic System Components : Double Acting Cylinder



Hydraulic System Components : Fixed Displacement Motor



LSHT Motor



Gear Motor



Symbol

Hydraulic System Components: Pilot Control Valves



VP04 Pneumatic Controls



PCL04 Hydraulic Controls

Hydraulic System Components: Electronic Controls



Hydraulic Oil How Much



- **General Rule – 1 ½ X the Rated Flow of the Pump at 1200 rpm's**
- **Example P51 Pump with 6.38 Cubic Inches of Displacement**
- **$[6.38 \text{ cid} \times 1200 \text{ rpm} / 231] \times 1.5 = 50 \text{ Gallons}$**

HYDRAULIC OIL WHAT KIND



Grade AW22 – Very Cold Temperature (Northern Canada)

Grade AW32 - Good All Temperature (Most Common)

Grade AW68 - Extremely High Temperatures (Florida-New Mexico-Arizona- Texas-Southern California)

Make Sure To Use Non-Foaming Hydraulic Oil

HYDRAULIC OIL HOW TO CHECK



- **Take a Sample from the middle of the Hydraulic Tank**
- **Does the Fluid Look Milky?**
- **Does the Fluid have foam or air bubbles?**
- **Is the Fluid Black or Burnt Looking?**
- **Does the Fluid Smell Like Something the Cat Brought In?**
- **Is their Presence of Metal Particles in the Fluid?**

HYDRAULIC OIL – WHEN TO REPLACE



Indicator Gauge (15 PSI)



Indicator Gauge (25 PSI)

- When these gauges are in the red it is time to replace the filter element
- If you have no gauge on the filter make it a point to go and purchase one from your nearest distributor

HYDRAULIC TANKS - WHAT SIZE

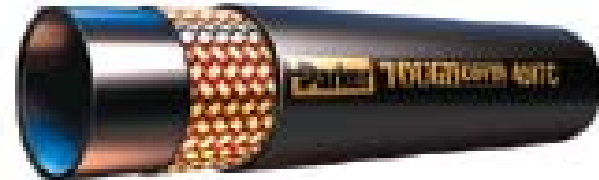


- If the cylinder requires 50 gallons or more to extend you will need a 70 to 75 gallon tank, or the bed will not fully extend.
- General rule works most of the time, but make sure you do not run out of fluid when operating the equipment

HYDRAULIC TANKS – WHAT SHOULD BE INCLUDED



HYDRAULIC HOSES – WHAT KIND



- Since we are using hydraulic oil we need a hydraulic hose
- Suction Hose – 100R4
- Medium Pressure Hose up to 3000 PSI 100R17
- All Hoses Listed are for Standard Dump Truck/ Trailer

HYDRAULIC PUMPS - WHAT DETERMINES THE TYPE OF PUMP

Gear



Vane



Piston



Variable Volume Piston



Least

Most
Expensive

- **Flow Required**
- **RPM's the Pump will operate**
- **Hydraulic System Pressure Requirement**
- **Type of Hydraulic Valve [Open or Closed]**
- **Budget / Hours of Operation**
- **When full flow is not required, variable volume piston pumps are more attractive**

HYDRAULIC PUMPS USED WITH OPEN CENTER VALVES



- Gear Pump
- Vane Pumps
- Fixed Displacement Piston

HYDRAULIC PUMPS USED WITH CLOSED CENTER VALVES

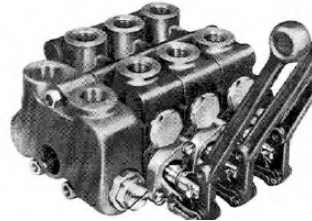


- **Variable Volume Pressure Compensated Piston Pump**
- **Variable Volume Load Sense Controls**

HYDRAULIC VALVES- WHAT KIND OF VALVE



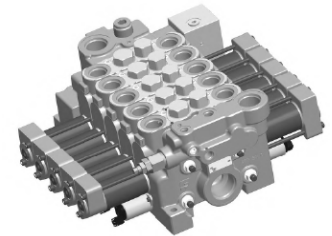
V040



V20



DVA/DVG 20/35



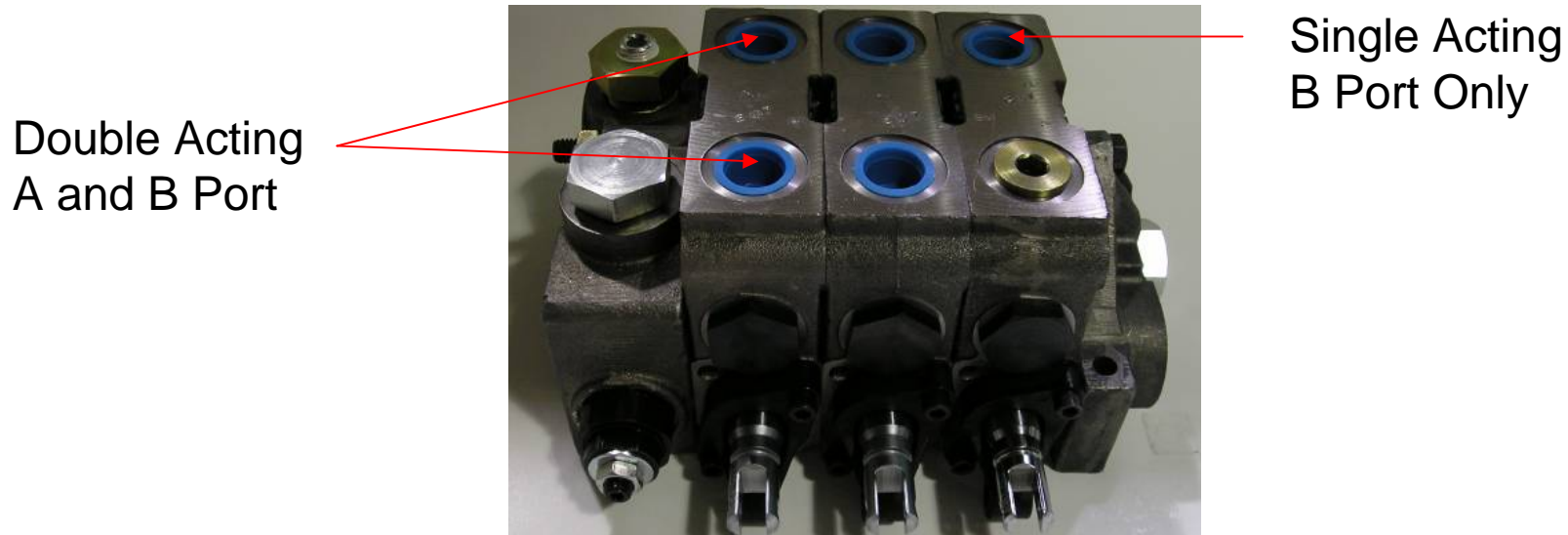
VP170

- **System Flow Requirement**
- **System Pressure Requirement**
- **Amount of Operator Control Required**
- **HP Efficiency – Heat Issues**

HYDRAULIC VALVES SIZE & SYSTEM PRESSURE

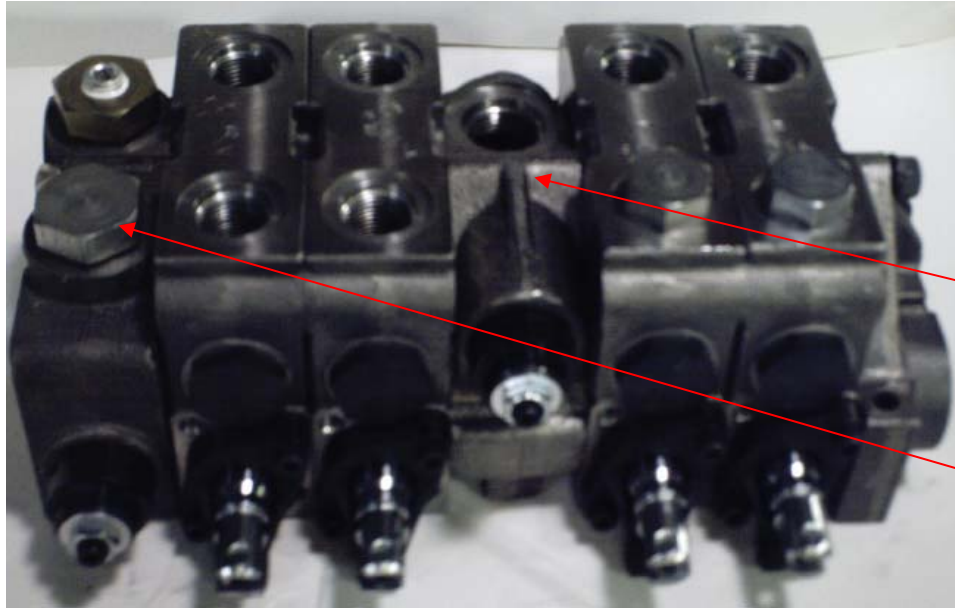
Valve	Type	Flow	Max PSI
V040	Open	10.6 GPM	4350 PSI
V20	Open	25.0 GPM	3500 PSI
V20LS	Closed/LS	25.0 GPM	3500 PSI
DVA20	Open	40.0 GPM	2500 PSI
DVG20	Open	40.0 GPM	3500 PSI
DVA35	Open	70.0 GPM	2500 PSI
DVG35	Open	70.0 GPM	3500 PSI
VP170	Closed/LS	60.0 GPM	5000 PSI

HYDRAULIC VALVE – SINGLE ACTING / DOUBLE ACTING



- **Single acting valves only have one work port [Generally the B Port]**
- **Double acting valves have two work ports [A Port and B Port]**

HYDRAULIC MID INLETS



Mid Inlet

Main Inlet

- **Types**
 - **Combined Flow - Mid Inlet (Inlet 1 + Inlet 2)**
 - **Split Flow - Mid Inlet (Inlet 1 separate Inlet 2)**

HYDRAULIC VALVE – POWER BEYOND

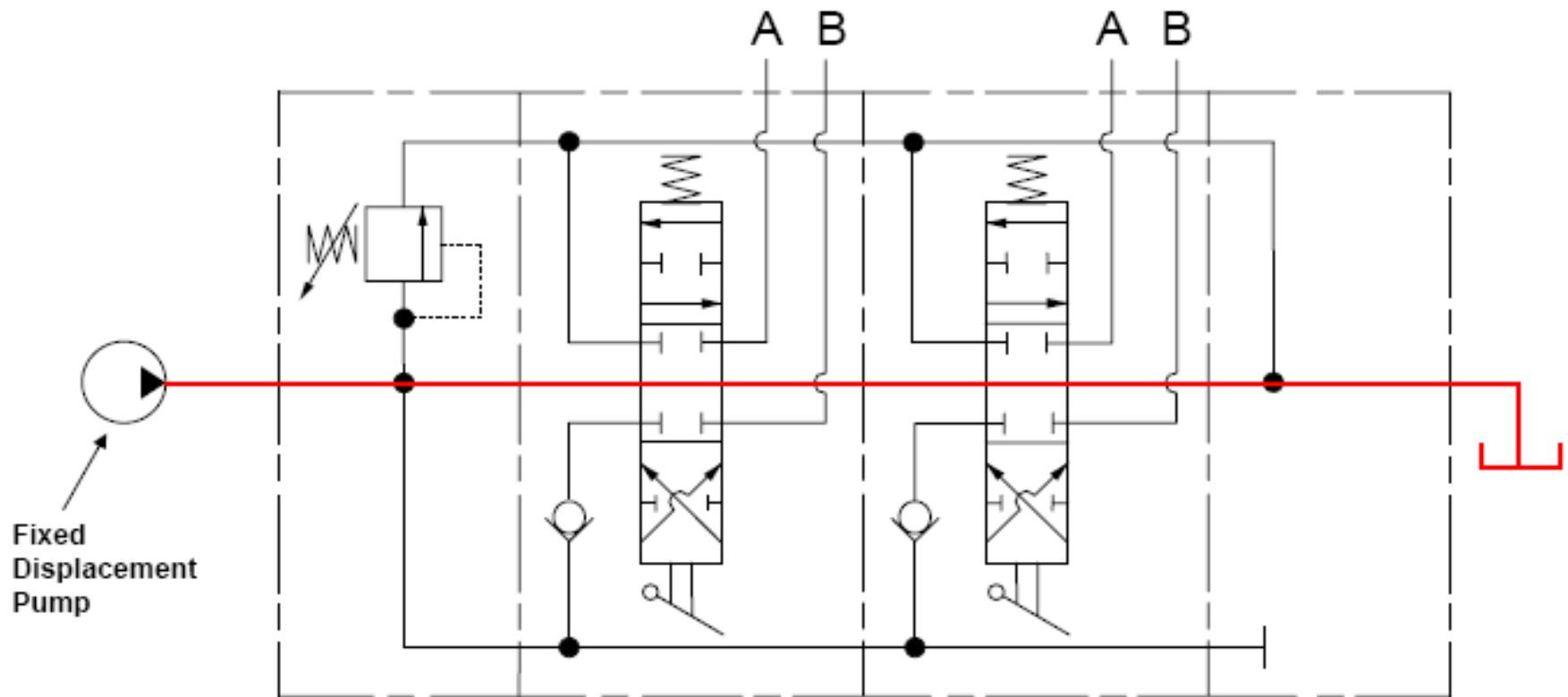


Power Beyond Port
to additional valve

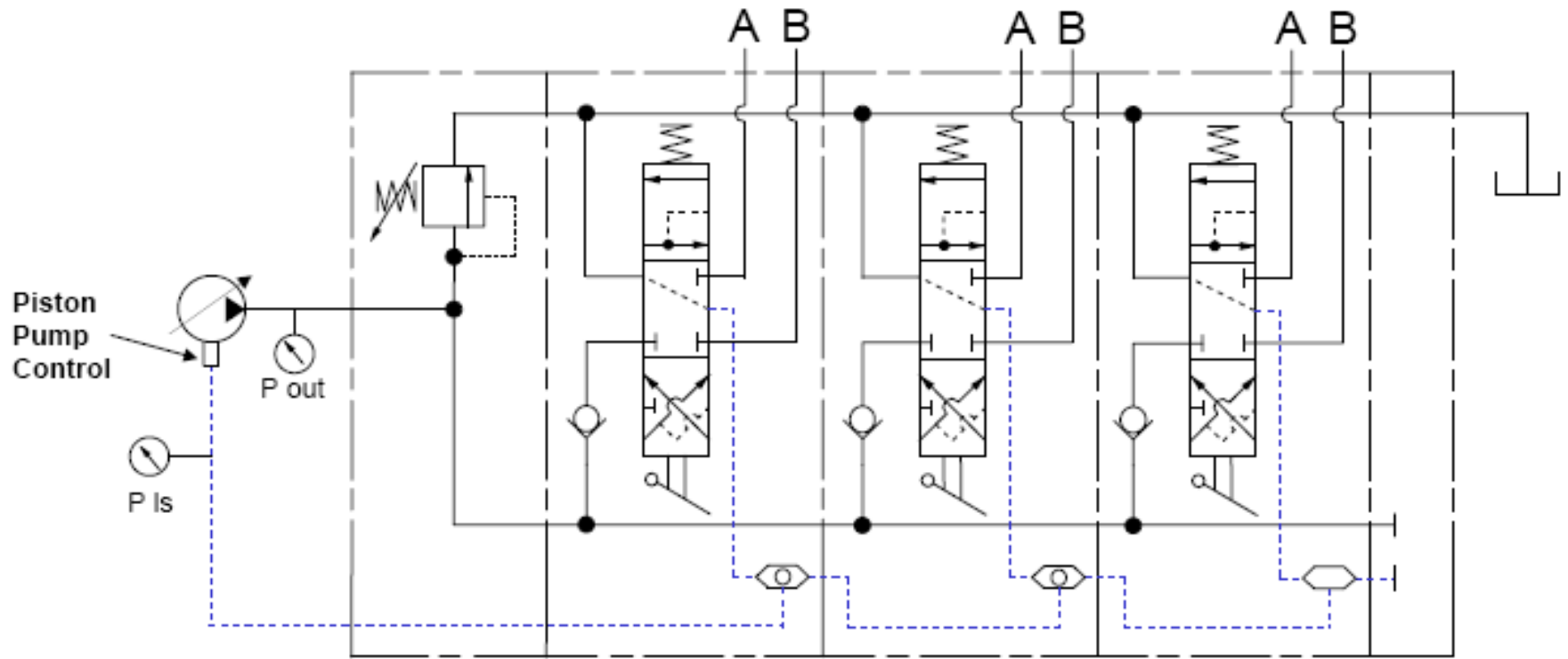
Return Line Port

- **Purpose**
 - **Allow for multiple valve sections to be run from a single section pump**

Open Center Schematic



Closed Center LS Schematic



Horse Power Consumption

$$\text{HP} = \frac{\text{GPM} \times \text{PSI}}{1714}$$

Rule of Thumb

- Gear Pumps are ideal when full pump flow is being used
- LS Pumps are ideal when full pump flow is not used

HYDRAULIC CYLINDERS - Rod and Telescopic



Rod Cylinder



Telescopic Cylinder
Multiple Stages

- Rod – Single Ram
- Telescopic – Multiple Stages

MOBILE CYLINDERS – SINGLE ACTING DOUBLE ACTING

- **Single Acting Cylinders**
 - **Power Up**
 - **Gravity Down**
 - **Single Hose Connection**
 - **3 Way Valve Work Section**
- **Double Acting Cylinders**
 - **Power Up**
 - **Power Down**
 - **Two Hose Connection**
 - **4 Way Valve Work Section**

CYLINDERS – BLEEDING AIR FROM THE CYLINDER



A messy job but has to be done

- **Reasons telescopic cylinders require bleeding air**
 - **To avoid spongy action**
 - **To avoid cylinders raising in the wrong sequence**
 - **To avoid costly repairs**
- **How to bleed a telescopic cylinder (Single Acting)**
 - **Raise the cylinder almost to the top**
 - **Lower the bed to about 2 feet from the bottom**
 - **Turn the adjustment screw CCW and then close**
 - **Repeat if necessary**

Hydraulic Motors - Types



LSHT MOTOR



GEAR MOTOR

- **LSHT Motors**
- **Gear Motors**

HYDRAULIC MOTORS – HOW MOTORS WORK



- **Hydraulic Motors provide rotary motion**
- **Pressurized oil drives the rotating group for desired rotary motion**
- **This is not a pump**

HYDRAULIC FILTRATION

SPIN ON & CANISTER



- **Spin on filtration [generally low pressure return line filters]**
- **Canister filtration [medium to high pressure inline filtration located between the hydraulic pump and the hydraulic valve]**

HYDRAULIC FILTRATION

HOW FILTERS ARE SELECTED



- **Flow and Pressure**
- **Microns – Degree of Filtration**
- **Absolute versus Nominal**

PTO'S TYPES



- **Manual PTO's**
 - **Used with manual transmissions**
 - Six or Eight Bolt Opening
 - Pneumatic Actuator or Cable
 - Truck Clutch must be disengaged
 - Hot Shifts for manual transmission are available in pneumatically engage clutch packs
 - Truck Clutch does not need to be disengaged
- **Hot Shift PTO's**
 - **Used with automatic transmissions**
 - Six or Ten Bolt openings
 - Recommended Engagement less than 1000 rpm's

PTO – MANUAL MOST POPULAR



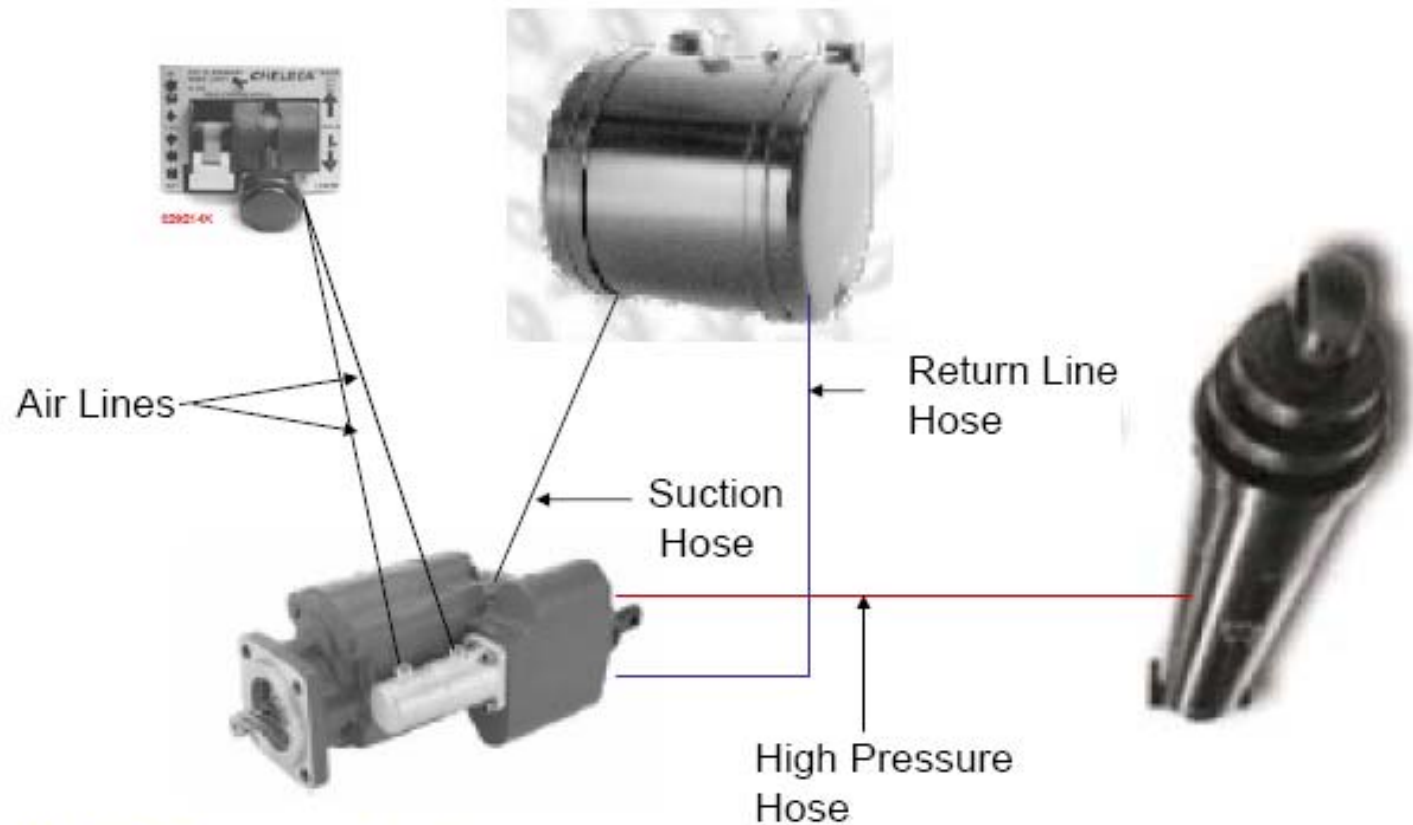
- **Six Bolt 442 - Eight Bolt 489**
- **Rugged Cast Iron construction versus aluminum**
- **Grease able Flanges Available without pump removal**
- **Note: PTO Torque ratings must meet application**
 - **Pump, Compressors, Blowers, Water Pumps, Propane Pumps, etc.**
- **Note: 489 Must have pump support bracket for pumps in excess of 40 lbs.**

PTO'S for Automatic Transmissions



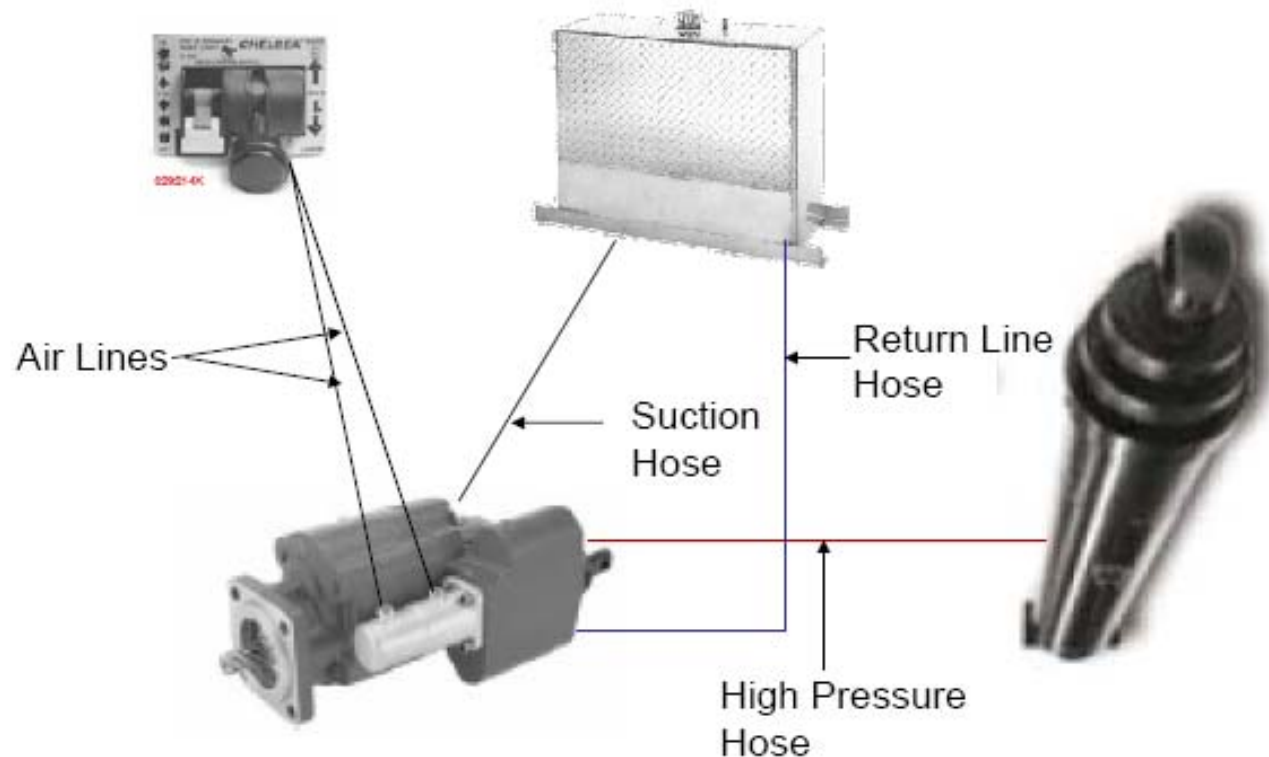
- **270/271**
 - **Six Bolt**
 - **Aisin, Allison, Dodge, GM, Mitsubishi**
- **277/278**
 - **10 Bolt**
 - **Wet Spine extending Shaft life by a factor of 10**
 - **Allison World Transmission, Caterpillar Automatic**
 - **Popular with large fleets, maintenance issues with manual transmissions**
- **246**
 - **Ford**

DUMP TRUCK - Three Line System



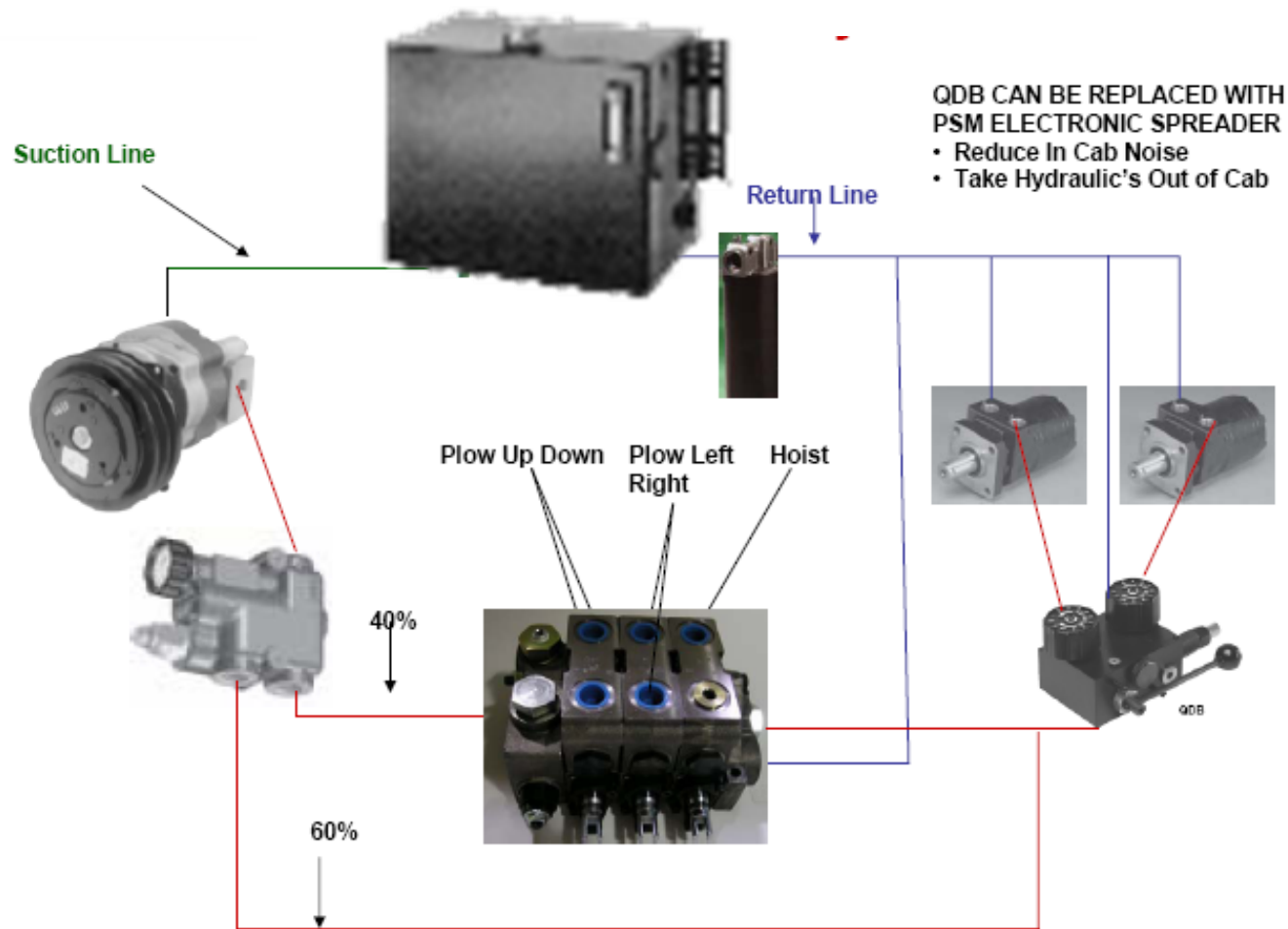
**Highly Recommended
Best Service Life**

Dump Trailer – Three Line System One Line to the Trailer



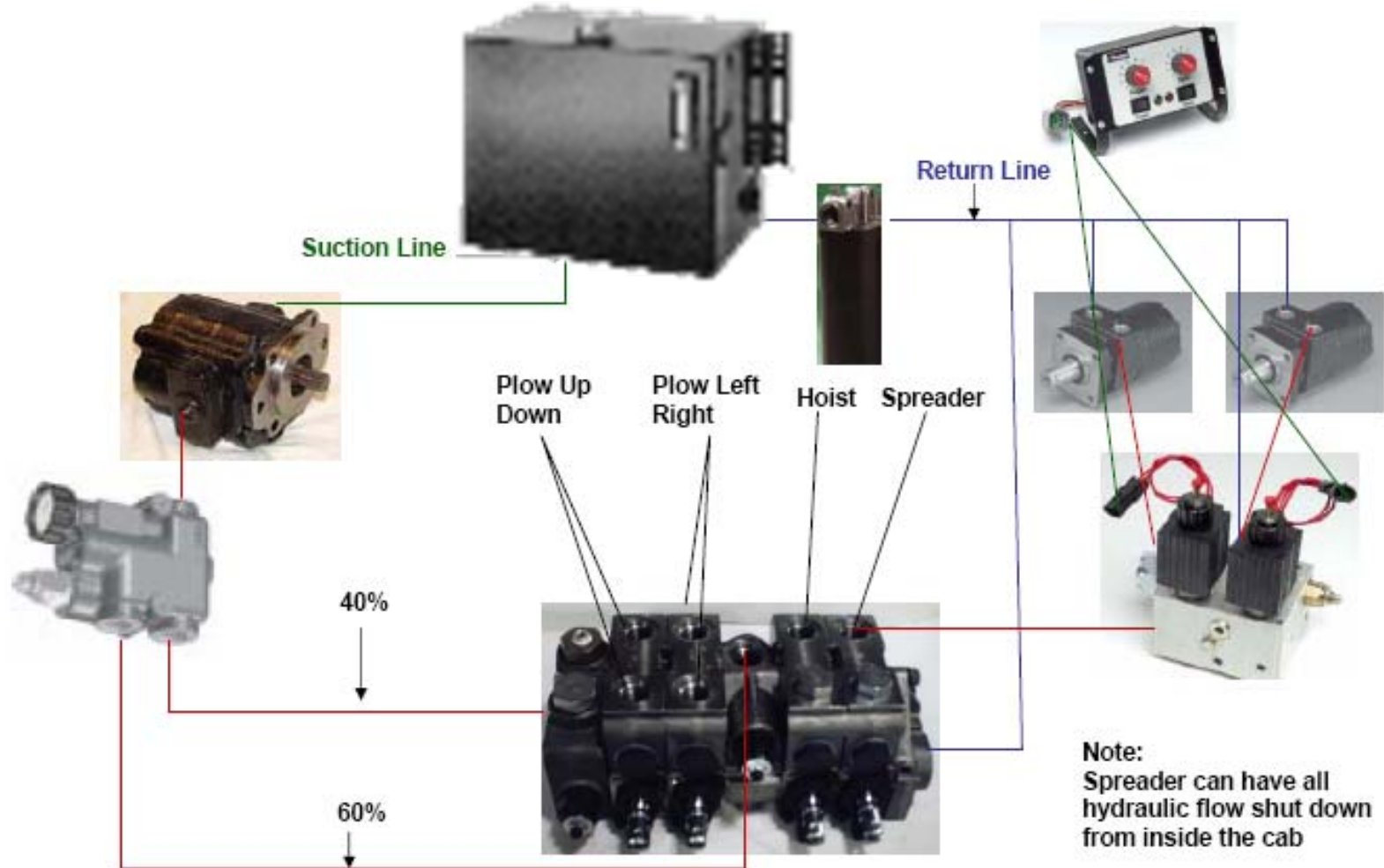
**Highly Recommended
Best Service Life**

QDB Manual Spreader Valve with Power Beyond

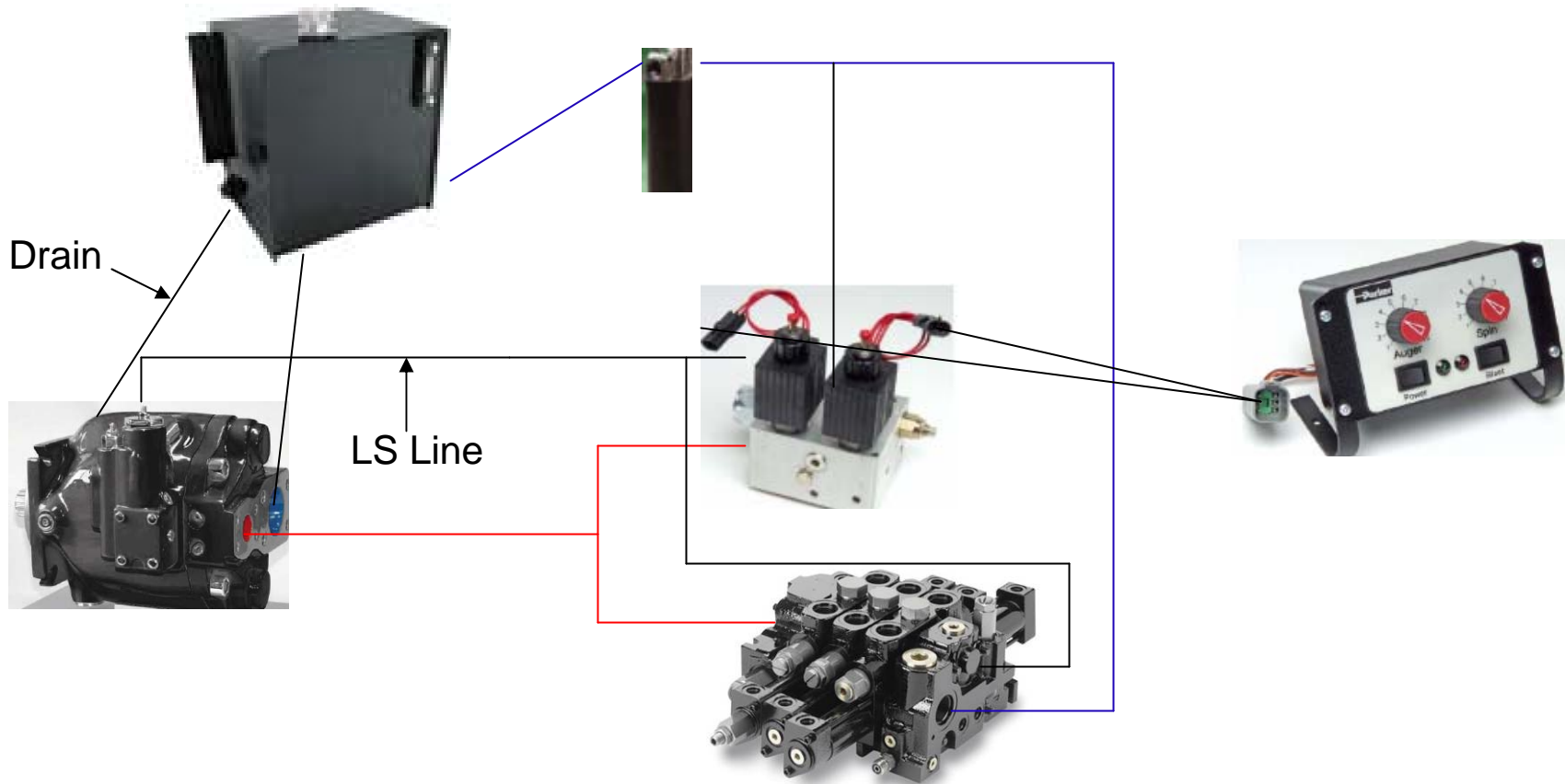


PSM 1000 Spreader Valve

No In Cab Hydraulics



PSM1000 Spreader Valve with LS



Note: Minimum of 3 work sections / Plow Up-Down / Plow Left-Right / Hoist / PSM 1000

Questions





Parker Hannifin Corporation
595 Schelter Road
Lincolnshire, IL 60069
Tel: (847)955-5253
Fax: (847) 821-9564
www.parker.com/hydraulics